

REMARKS

Claims 1, 8, 14, 55, 82, 84-85 and 87-88 have been amended. Additionally, Claims 7, 50-54 and 56-59 have been canceled. New Claims 89-99 have been added. The amendments to Claims 84 and 87-88, and new Claims 91-92, 96 and 98-99 are supported by the specification as originally filed, including, page 11, lines 8-14 and page 11, line 20 to page 12, line 4. Likewise, the amendments to Claims 82, 85-86 and 89, and new Claims 90, 93-95 and 97 are also supported by the specification as filed. For example, support for the amendments to Claims 82, 85-86 and 89, and new Claims 90, 93-95 and 97 can be found on page 5, lines 1-23 and page 12, line 8 to page 13, line 4. Claim 55 has been amended to include compounds exemplified in Examples 11, 12, 41, 49, 69, 71 and 77. Claims 7, 53-54 and 56-59 have been canceled merely to avoid any issues of double patenting with respect to U.S. Patent No. 6,815,458. In response to the Office Action mailed January 25, 2008, Applicants have carefully considered all of the rejections raised by the Examiner and respond thereto in detail below.

Rejection of Claims 1-14, 53-60 and 79-88 under 35 U.S.C. § 112, Second Paragraph

“substituted”

Claims 1-14, 53-60 and 79-88 stand rejected under 35 U.S.C. § 112, second paragraph because the patent office alleges that the term “substituted” is indefinite. As stated in the present specification, only aryl, heteroaryl, alkyl and heteroalkyl groups can be substituted. Furthermore, the possible substituents that can be present on the aforementioned groups is recited in the specification at page 11, lines 8-19 and page 11, line 20 to page 12, line 4. Thus, the term “substituted” as used in independent Claims 1, 8 and 14 is definite. Claims 2-7, 9-13, 53-60 and 79-88 depend directly or through another claim(s) to one of Claims 1, 8 and 14. Thus, Applicants respectfully request the Examiner to reconsider and withdraw the rejection of Claims 1-14, 53-60 and 79-88.

“organyl group”

Claims 1-5 stand rejected under 35 U.S.C. § 112, second paragraph for allegedly being indefinite. Applicants note that in the Response to the Restriction Requirement filed on December 21, 2007, “a cyclic or straight chained or branched acyclic organyl group” was

amended to recite “a straight-chained or branched alkyl, a straight-chained or branched alkenyl, a straight-chained or branched alkynyl, a cycloalkyl, a cycloalkyl(C₁₋₆ alkyl).” This amendment is supported by the specification as originally filed, for example, on page 9, lines 20-34 and page 10, lines 1-6. Applicants respectfully submit that the terms “alkyl”, “alkenyl”, “alkynyl”, “cycloalkyl” and “cycloalkyl(C₁₋₆ alkyl)” are terms well understood by those skilled in the art. In view of the amendment and the knowledge of those skilled in the art, Applicants respectfully submit Claim 1 is definite. Claims 2-5 depend directly or through another claim(s) to Claim 1. Therefore, Applicants respectfully request the Examiner to reconsider and withdraw the rejection of Claims 1-5.

Rejection of Claims 1-14, 53-60 and 79-88 under 35 U.S.C. § 112, First Paragraph

“R”

As stated in the Office Action, Claims 1-14, 53-60 and 79-88 stand rejected under 35 U.S.C. § 112, first paragraph as allegedly not enabling all variables of R being substituted and unsubstituted. Applicants respectfully disagree.

As an initial matter, as discussed previously, only aryl, heteroaryl, aralkyl and heteroaralkyl groups can be substituted. In addition to the compounds noted by the Examiner, the present specification provides more than sufficient guidance to enable one skilled in the art to make and use compounds of Formula (I). One method for adding an R group to the piperdinyll ring is provided on page 35, lines 11-20 and shown in the scheme on page 37. Included disclosed in the present specification are the reagents and conditions for carrying out this method for adding the R group. A second method for adding an R group to the piperdinyll ring is recited on page 36, lines 1-8 and shown in the scheme on page 37. As with the first method, a list of reagents and conditions are provided in the specification. The specification also includes a third method on page 36, lines 9-24, which is shown in the scheme on page 37. Again, the specification recites reagents and conditions for this method. Additionally, as noted by the Examiner, the present specification provides a number of working examples to support enablement. Further, as acknowledged by the Examiner, the level of skill in the art is high (e.g., a masters or Ph.D. level chemists). Page 9 of the Office Action dated January 25, 2008.

Taken altogether, the present specification enables one of skill in the art to make and use the full scope of compounds encompassed by Claims 1, 8 and 14. Claims 2-7, 9-13, 53-60 and 79-88 depend directly or through one or more claims to Claims 1, 8 and 14. Accordingly, Applicants respectfully request that the Examiner reconsider and withdraw the rejection under 35 U.S.C. § 112, first paragraph of Claims 1-14, 53-60 and 79-88

“Prodrugs”

Claims 1-14, 53-60 and 79-88 stand rejected under 35 U.S.C. § 112, first paragraph for allegedly not enabling one skilled in the art to practice the full scope of the claim because the specification while enabled for “salt” is allegedly not enabled for “prodrugs”. Although Applicants disagree, in order to expedite allowance of the present application the term “prodrugs” has been removed from Claims 1, 8 and 14. Claims 2-7, 9-13, 53-60 and 79-88 depend directly or through one or more claims to Claims 1, 8 and 14. Thus, Claims 1-14, 53-60 and 79-88 as amended are fully enabled by the specification as filed. Accordingly, the Examiner is respectfully requested to reconsider and withdraw this rejection under 35 U.S.C. § 112, first paragraph.

Rejection of Claims 1-5, 8-12, 14, 60, 82-83 and 85-86 under 35 U.S.C. § 102(b)

Claims 1-5, 8-12, 14, 60, 82-83 and 85-86 stand rejected under 35 U.S.C. § 102(b) as allegedly anticipated by U.S. Patent No. 5,216,165 (hereinafter “Mobilio”). To be anticipatory under 35 U.S.C. § 102, a reference must teach each and every element of the claimed invention. See *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1379 (Fed. Cir. 1986). Moreover, pending claims must be “‘given their broadest interpretation consistent with the specification.” M.P.E.P. § 2111, Emphasis added. Here, Applicants respectfully submit that Mobilio does not anticipate because it does not teach each and every element of the claims.

The present specification at page 11, lines 8-19, defines the term “aryl group.” This definition includes a list of potential substituents for the aryl group, which includes amino and lower alkylamino. One skilled in the art understands an amino group to be $-NH_2$ group. See Appendix A, A DICTIONARY OF CHEMISTRY 29 (3d ed. 1996). Additionally, Applicants gives two examples of amino-substituted aryl groups: 3-aminophenyl, 4-aminophenyl. See specification

page 11, lines 15-19. These examples provide support that Applicants intended an amino group to be understood as -NH_2 .

Moreover, Applicants have defined the term lower alkylamino. A lower alkylamino is defined in the present specification to be "lower alkyl groups connected as substituents, via a nitrogen atom, which may carry one or two lower alkyl groups." See page 10, lines 13-14. If Applicants had intended the term amino to have the broad meaning given by the Examiner it would not have been necessary to define the term alkylamino as the term amino would have encompassed all forms of substituted amine groups. In addition, as recited in the specification, lower alkyl groups are " C_{1-6} cyclic, straight-chained or branched aliphatic substituent groups connected via a carbon." Hence, lower alkyl groups do not contain heteroatoms.

Thus, the $\text{-NH-chloroisoquinoline}$ group in Mobilio is not an amino group as that term is used in the present application because the nitrogen does not have two hydrogens attached. The $\text{-NH-chloroisoquinoline}$ group is also not a lower alkylamino group as that term is used in the present application because the quinoline is not a lower alkyl group due to the inclusion of a nitrogen atom (i.e. a heteroatom).

Thus, in light of the specification, the $\text{-NH-chloroisoquinoline}$ group of Mobilio is neither an amino group nor a lower alkylamino group. Therefore, Example 5, column 11 of Mobilio does not anticipate Claim 1, 8 or 14. Claims 2-5, 9-12, 60, 82-83 and 85-86 depend directly or through another claim(s) to Claims 1, 8 and 14. In view of the arguments presented above, the Examiner is respectfully requested to reconsider and withdraw this rejection.

Rejection of Claims 1-14, 53-60 and 79-88 under 35 U.S.C. § 103(a)

Claims 1-14, 53-60 and 79-88 stand rejected under 35 U.S.C. § 103(a) as allegedly be unpatentable over Thomas et al., *Tet. Lett.* (1997) 38:5099-5102 (hereinafter "Thomas"). To establish a prima facie case of obviousness, the claimed invention "as a whole" must have been obvious at the time the invention was made to a person of ordinary skill in the art. M.P.E.P. § 2142. To support any rejection under 35 U.S.C. § 103, there must be a clear articulation of a reason(s) why the claimed invention would have been obvious such as "[s]ome teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention,"

and a reasonable expectation of success. M.P.E.P. § 2143, (G). Applicants respectfully disagree that Thomas renders the pending claims obvious.

As acknowledged by the Examiner, the two compounds in Thomas have Ar₁ and Ar₂ being unsubstituted phenyl groups. In fact, none of the compounds in Table 3 are substituted. As stated by the Federal Circuit, "in order to find a *prima facie* case of unpatentability in such instances, a showing that the 'prior art would have suggested making the specific molecular modifications necessary to achieve the claimed invention' was also required." *Takeda Chemical Indus., Ltd. v. Alphapharm Pty., Ltd.*, 492 F.3d 1350, 1356 (Fed. Cir. 2007). The Federal Circuit further stated that "in cases involving new chemical compounds, it remains necessary to identify some reason that would have led a chemist to modify a known compound in a particular manner to establish *prima facie* obviousness of a new claimed compound." *Id.* at 1357. Nowhere in Thomas is there disclosed a reason for modifying the compounds cited by the Examiner to include a substituted phenyl group. Thus, Thomas fails to provide the necessary reason that would have led a chemist to modify the compounds cited by the Examiner to included at least one substituted aryl ring.

Furthermore, as stated in the Manual of Patent Examining Procedure, "[i]f the prior art does not teach any specific or significant utility for the disclosed compounds, then the prior art is unlikely to render structurally similar claims *prima facie* obvious." M.P.E.P. § 2144.09, VI. Again, nowhere in Thomas is any specific or significant utility disclosed for the compounds cited by the Examiner.

Taken altogether, a *prima facie* case of obviousness has not been established. As a result, Claims 1, 8 and 14 are non-obvious over Thomas. Claims 2-14, 53-60 and 79-88 depend directly or through one or more claims to Claims 1, 8 and 14. Applicants respectfully request the Examiner reconsider and withdraw this rejection.

Double Patenting

U.S Patent No. 6,756,393

Claims 1-14, 53-60 and 79-88 have been rejected on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over Claims 1-5 of U.S. Patent No.

Application No.: 10/802,970
Filing Date: March 16, 2004

6,756,393. Applicants respectfully request that the rejection be held in abeyance until the claims of the present application are otherwise allowable.

U.S Patent No. 7,253,186

Claims 1-14, 53-60 and 79-88 have been rejected on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over Claims 1-21 of U.S. Patent No. 7,253,186. Applicants respectfully request that the rejection be held in abeyance until the claims of the present application are otherwise allowable.

U.S Patent No. 6,815,458

Claims 1-14, 53-60 and 79-88 have been rejected on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over Claims 1-12 of U.S. Patent No. 6,815,458. Applicants respectfully request that the rejection be held in abeyance until the claims of the present application are otherwise allowable.

U.S. Patent Publication No. 2006/0194778

Claims 1-14, 53-60 and 79-88 have been provisionally rejected on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over the pending claims of U.S. Patent Publication No. 2006/0194778. Applicants respectfully request that the rejection be held in abeyance until the claims of the present application are otherwise allowable.

U.S. Patent Publication No. 2006/0205722

Claims 1-14, 53-60 and 79-88 have been provisionally rejected on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over the pending claims of U.S. Patent Publication No. 2006/0205722. Applicants respectfully request that the rejection be held in abeyance until the claims of the present application are otherwise allowable.

U.S. Patent Publication No. 2006/0199818

Claims 1-14, 53-60 and 79-88 have been provisionally rejected on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over the pending claims of

Application No.: 10/802,970
Filing Date: March 16, 2004

U.S. Patent Publication No. 2006/0199818. Applicants respectfully request that the rejection be held in abeyance until the claims of the present application are otherwise allowable.

U.S. Patent Publication No. 2006/0094758

Claims 1-14, 53-60 and 79-88 have been provisionally rejected on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over the pending claims of U.S. Patent Publication No. 2006/0094758. Applicants respectfully request that the rejection be held in abeyance until the claims of the present application are otherwise allowable.

U.S. Patent Publication No. 2004/0100660

Claims 1-14, 53-60 and 79-88 have been provisionally rejected on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over the claims of U.S. Patent Publication No. 2004/0100660. U.S. Publication No. 2004/0100660 is entitled "Image reading apparatus" with Suita-shi Tetsuya Yoshioka as the first inventor. Consequently, Applicants respectfully submit that U.S. Patent Publication No. 2004/0100660 does not present issues of double patenting for the present application.

Rejoinder

Upon allowance of the compound claims, Applicants request rejoinder of the method claims, Claims 15-49, 66-60 and 72-75, pursuant to M.P.E.P. § 821.04. Applicants also reserve the right to file continuation, divisional, or continuation-in-part applications to pursue the withdrawn subject matter.

No Disclaimers or Disavowals

Although the present communication may include alterations to the application or claims, or characterizations of claim scope or referenced art, Applicants are not conceding in this application that previously pending claims are not patentable over the cited references. Rather, any alterations or characterizations are being made to facilitate expeditious prosecution of this application. Applicants reserve the right to pursue at a later date any previously pending or other broader or narrower claims that capture any subject matter supported by the present disclosure,

Application No.: 10/802,970
Filing Date: March 16, 2004

including subject matter found to be specifically disclaimed herein or by any prior prosecution. Accordingly, reviewers of this or any parent, child or related prosecution history shall not reasonably infer that Applicants have made any disclaimers or disavowals of any subject matter supported by the present application.

Co-Pending Applications of Assignee

Applicants wish to draw the Examiner's attention to the following co-pending applications of the present application's assignee. Applicants respectfully request the Examiner to consider whether the claims of any one or more of the following co-pending U.S. patent applications create any issues of double patenting with respect to any of the claims of the present application; and where relevant, to consider whether the disclosure of one or more of the following co-pending applications creates any issues of patentability with respect to any of the claims of the present application. Furthermore, Applicants respectfully encourages the Examiner to monitor the prosecution of the following co-pending applications during the pendency of the present application.

Serial Number	Title	Filed
11/417790	AZACYCLIC COMPOUNDS	May 3, 2006
11/417782	AZACYCLIC COMPOUNDS	May 3, 2006
11/299566	N-SUBSTITUTED PIPERIDINE DERIVATIVES AS SEROTONIN RECEPTOR AGENTS	Dec. 12, 2005
11/417866	N-SUBSTITUTED PIPERIDINE DERIVATIVES AS SEROTONIN RECEPTOR AGENTS	May 3, 2006
11/418353	N-SUBSTITUTED PIPERIDINE DERIVATIVES AS SEROTONIN RECEPTOR AGENTS	May 3, 2006
10/759561	SELECTIVE SEROTONIN 2A/2C RECEPTOR INVERSE AGONISTS AS THERAPEUTICS FOR NEURODEGENERATIVE DISEASES	Jan. 15, 2004
11/416527	SELECTIVE SEROTONIN 2A/2C RECEPTOR INVERSE AGONISTS AS THERAPEUTICS FOR NEURODEGENERATIVE DISEASES	May 3, 2006
11/416855	SELECTIVE SEROTONIN 2A/2C RECEPTOR INVERSE AGONISTS AS THERAPEUTICS FOR NEURODEGENERATIVE DISEASES	May 3, 2006
11/416594	SELECTIVE SEROTONIN 2A/2C RECEPTOR INVERSE AGONISTS AS THERAPEUTICS FOR NEURODEGENERATIVE DISEASES	May 3, 2006

Application No.: 10/802,970
Filing Date: March 16, 2004

11/235558	SYNTHESIS OF N-(4-FLUOROBENZYL)-N-(1-METHYLPIPERIDIN-4-YL)-N'-(4-(2-METHYLPROPYLOXY)PHENYLMETHYL)CARBAMIDE AND ITS TARTRATE SALT AND CRYSTALLINE FORMS	Sept. 26, 2005
11/235381	SALTS OF N-(4-FLUOROBENZYL)-N-(1-METHYLPIPERIDIN-4-YL)-N'-(4-(2-METHYLPROPYLOXY)PHENYLMETHYL)CARBAMIDE AND THEIR PREPARATION	Sept. 26, 2005
11/418341	SYNTHESIS OF N-(4-FLUOROBENZYL)-N-(1-METHYLPIPERIDIN-4-YL)-N'-(4-(2-METHYLPROPYLOXY)PHENYLMETHYL)CARBAMIDE AND ITS TARTRATE SALT AND CRYSTALLINE FORMS	May 3, 2006
11/417447	SYNTHESIS OF N-(4-FLUOROBENZYL)-N-(1-METHYLPIPERIDIN-4-YL)-N'-(4-(2-METHYLPROPYLOXY)PHENYLMETHYL)CARBAMIDE AND ITS TARTRATE SALT AND CRYSTALLINE FORMS	May 3, 2006
11/749115	SYNTHESIS OF N-(4-FLUOROBENZYL)-N-(1-METHYLPIPERIDIN-4-YL)-N'-(4-(2-METHYLPROPYLOXY)PHENYLMETHYL)CARBAMIDE AND ITS TARTRATE SALT AND CRYSTALLINE FORMS	May 15, 2007

Conclusion

In view of the foregoing Amendments to the Claims and Remarks, Applicants respectfully submit that this application is in condition for allowance. Should the Examiner have any remaining concerns which might prevent the prompt allowance of this application, the Examiner is respectfully invited to contact the undersigned at the telephone number appearing below. Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Application No.: 10/802,970
Filing Date: March 16, 2004

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: 4-24-08

By: Ryan E. Melnick
Ryan E. Melnick
Registration No. 58,621
Attorney of Record
Customer No. 20,995
(619) 235-8550

4866679-akr
021108

APPENDIX A

**Oxford
Paperback
Reference**

The most authoritative and up-to-date reference books for both students and the general reader.

Abbreviations
Accounting
Art and Artists
Ballet
Biology
Botany
Business
Card Games
Chemistry
Christian Church
Classical Literature
Computing
Dates
Earth Sciences
Ecology
English Christian Names
English Etymology
English Language
English Literature
English Place-Names
Finance
Food and Nutrition
Fowler's Modern English Usage
Geography
Irish Mythology
King's English
Law
Literary Terms
Mathematics
Medical Dictionary
Modern Quotations
Modern Slang
Music
Nursing
Opera
Philosophy
Physics
Politics
Popes
Popular Music
Proverbs
Quotations
Sailing Terms
Saints
Science
Ships and the Sea
Sociology
Sports
Statistics
Theatre
Twentieth-Century History
Twentieth-Century Poetry
Weather Facts
Women Writers
Word Games
World Mythology
Zoology

A Dictionary of

Chemistry

THIRD EDITION

Edited by
JOHN DAINTITH

Oxford New York
OXFORD UNIVERSITY PRESS
1996

Oxford University Press, Walton Street, Oxford oxa 600
 Oxford New York
 Athens Auckland Bangkok Bombay
 Calcutta Cape Town Chennai Colombo
 Dares Salaam Delhi
 Florence Hong Kong Istanbul Karachi
 Kuala Lumpur Madrid Melbourne
 Mexico City New Delhi
 Taipei Tokyo Warsaw Singapore
 and associated companies in
 Berlin Boston

Oxford is a trade mark of Oxford University Press

© Market House Books Ltd. 1985, 1990, 1996

First published 1985 as *A Concise Dictionary of Chemistry*
 Second edition 1990
 Third edition 1996

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, without the prior permission in writing of Oxford University Press. This includes photocopying, recording, or by any information storage and retrieval system. For those organizations in the UK who are also registered with the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923, USA, authorized users may copy material (beyond the limits permitted by sections 107 and 108 of US copyright law) subject to payment to CCC of the per copy fee of \$05.00. This consent does not extend to multiple copying for promotional or commercial purposes. ISI Tear Sheet Service, 3501 Market Street, Philadelphia, PA 19104, USA, is authorized to supply single copies of separate articles for private use only. For all other use, permission should be sought from Oxford University Press. Reproduction outside the UK: This publication is registered at the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923, USA. Organizations in the USA who are also registered with CCC may therefore copy material (beyond the limits permitted by sections 107 and 108 of US copyright law) subject to payment to CCC of the per copy fee of \$05.00. This consent does not extend to multiple copying for promotional or commercial purposes. For all other use, permission should be sought from Oxford University Press.

This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, re-sold, hired out or otherwise circulated in any form of binding or cover other than that in which it is published, and that the same condition including this condition being imposed on the subsequent purchaser.

British Library Cataloguing in Publication Data

Data available

Library of Congress Cataloguing in Publication Data

ISBN 0-19-200031-0

10 9 8 7 6 5 4 3 2 1

Printed in Great Britain by
 Macbays plc
 Chatham, Kent

Preface

This dictionary is derived from the *Concise Science Dictionary*, first published by Oxford University Press in 1984 (third edition, 1996). It consists of all the entries relating to chemistry in this dictionary, including physical chemistry, as well as many of the terms used in biochemistry. For this third edition, many new terms have been added reflecting recent advances in techniques, concepts, and materials. Particular coverage is given to modern fields, such as fullerene chemistry and supramolecular chemistry.

An asterisk placed before a word used in an entry indicates that this word can be looked up in the dictionary and will provide further explanation or clarification. However, not every word that appears in the dictionary has an asterisk placed before it. Some entries simply refer the reader to another entry, indicating either that they are synonyms or abbreviations or that they are most conveniently explained in one of the dictionary's longer articles. Synonyms and abbreviations are usually placed within brackets immediately after the headword. Terms that are explained within an entry are highlighted by being printed in *italic type*.

The more physical aspects of physical chemistry and the physics itself will be found in *A Dictionary of Physics*, which is a companion volume to this dictionary. *A Dictionary of Biology* contains a more thorough coverage of the biophysical and biochemical entries from the *Concise Science Dictionary* together with the entries relating to biology.

SI units are used throughout this book and its companion volumes.

JO, 1996

aluminium trimethyl

dioxide, sulphur trioxide, and aluminium oxide. Its solutions are acidic because of hydrolysis.

Aluminium sulphate is commercially one of the most important aluminium compounds; it is used in sewage treatment (as a flocculating agent) and in the purification of drinking water, the paper industry, and in the preparation of mordants. It is also a fire-proofing agent. Aluminium sulphate is often wrongly called *alum* in these industries.

aluminium trimethyl See trimethylaluminium.

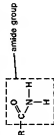
alums A group of double salts with the formula $A_2SO_4 \cdot B_2(SO_4)_3 \cdot 24H_2O$, where A is a monovalent metal and B a trivalent metal. The original example contains potassium and aluminium (called *potash alum* or simply *alum*); its formula is often written $AlK(SO_4)_2 \cdot 12H_2O$ (aluminium potassium sulphate-12-water). *Ammonium alum* is $AlNH_4(SO_4)_2 \cdot 12H_2O$, *chrome alum* is $KCr(SO_4)_2 \cdot 12H_2O$ (see potassium chromium sulphate), etc. The alums are isomorphous and can be made by dissolving equivalent amounts of the two components in water and recrystallizing. See also **aluminium sulphate**.

alunogenite A mineral form of hydrated *aluminium sulphate, $Al_2(SO_4)_3 \cdot 18H_2O$.

amalgam An alloy of mercury with one or more other metals. Most metals form amalgams (iron and platinum are exceptions), which may be liquid or solid. Some contain definite intermetallic compounds, such as $NaHg_2$.

americium Symbol Am. A radioactive metallic transuranic element belonging to the *actinoids; an 85, mass number of most stable isotope 243 (half-life 7.95×10^4 years); r.d. 13.67 ($20^\circ C$); m.p. $994 \pm 4^\circ C$; b.p. $2607^\circ C$. Ten isotopes are known. The element was discovered by G. T. Seaborg and associates in 1945, who obtained it by bombarding uranium-238 with alpha particles.

amethyst The purple variety of the mineral *quartz. It is found chiefly in Brazil, the Urals (Soviet Union), Arizona (USA), and Uruguay. The colour is due to impurities, especially iron oxide. It is used as a gemstone.

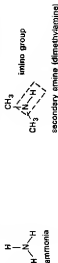


Amide structure

amides 1. Organic compounds containing the group $-CONH_2$ (the *amide group*). Amides are volatile solids; examples are ethanamide, CH_3CONH_2 , and propanamide, $C_2H_5CONH_2$. They are made by heating the ammonium salt of the corresponding carboxylic acid. 2. Inorganic compounds containing the ion NH_2^- , e.g. KNH_2 and $CaNH_2$. They are formed by the reaction of ammonia with electropositive metals.

amine salts

amination A chemical reaction in which an amino group ($-NH_2$) is introduced into a molecule. Examples of amination reaction include the reaction of halogenated hydrocarbons with ammonia (high pressure and temperature) and the reduction of nitro compounds and nitriles.



Examples of amines

amines Organic compounds derived by replacing one or more of the hydrogen atoms in ammonia by organic groups (see illustration). *Primary* amines have one hydrogen replaced, e.g. methylamine, CH_3NH_2 . They contain the functional group $-NH_2$ (the *amino group*). *Secondary* amines have two hydrogens replaced, e.g. methylamine, CH_3CH_2NH . *Tertiary* amines have all three hydrogens replaced, e.g. trimethylamine, $(CH_3)_3N$. Amines are produced by the decomposition of organic matter. They can be made by reducing nitro compounds or amides. See also **imine**.

amine salts Salts similar to ammonium salts in which the hydrogen atoms attached to the nitrogen are replaced by one or more organic groups. Amines readily form salts by reaction with acids, gaining a proton to form a positive ammonium ion. They are named as if they were substituted derivatives of ammonium compounds, for example,

dimethylamine ($CH_3)_2NH$ will react with hydrogen chloride to give dimethylammonium chloride, which is an ionic compound $[(CH_3)_2NH]^+ [Cl]^-$. When the amine has a common nonsystematic name the suffix *am* can be used; for example, phenylamine (aniline) would give $[C_6H_5NH_2]^+ [Cl]^-$. Known as *anilinium chloride* formerly, such compounds were sometimes called *hydrochlorides*, e.g. aniline hydrochloride with the formula $C_6H_5NH_2 \cdot HCl$.

Salts formed by amines are crystalline substances that are readily soluble in water. Many insoluble *alkaloids (e.g. quinine and atropine) are used medicinally in the form of soluble salts (hydrochlorides). If alkali (sodium hydroxide) is added to solutions of such salts the free amine is liberated.

If all four hydrogen atoms of an ammonium salt are replaced by organic groups a *quaternary ammonium compound* is formed. Such compounds are made by reacting tertiary amines with halogen compounds; for example, trimethylamine ($(CH_3)_3N$) with chloromethane (CH_3Cl) gives tetramethylammonium chloride, $(CH_3)_4N^+ Cl^-$. Salts of this type do not liberate the free amine when alkali is added, and quaternary hydroxides